Use of Emergency Departments among Working Age Adults with Disabilities: A Problem of Access and Service Needs

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Objective. To examine the relationship between emergency department (ED) use and access to medical care and prescription medications among working age Americans with disabilities.

Data Source. Pooled data from the 2006–2008 Medical Expenditure Panel Survey (MEPS), a U.S. health survey representative of community-dwelling civilians.

Study Design. We compared the health and service utilization of two groups of people with disabilities to a contrast group without disability. We modeled ED visits on the basis of disability status, measures of health and health conditions, access to care, and sociodemographics.

Data Extraction. These variables were aggregated from the household component, the medical condition, and event files to provide average annual estimates for the period spanning 2006–2008.

Principal Findings. People with disabilities accounted for almost 40 percent of the annual visits made to U.S. EDs each year. Three key factors affect their ED use: access to regular medical care (including prescription medications), disability status, and the complexity of individuals' health profiles.

Conclusions. Given the volume of health conditions among people with disabilities, the ED will always play a role in their care. However, some ED visits could potentially be avoided if ongoing care were optimized.

Key Words. (MeSH): persons with disabilities, emergency medical services, health services accessibility

INTRODUCTION

Adults with disabilities, particularly those who are working age, have become an important focus of U.S. health care reform. This is due not only to the high volume of health services they receive but the complexity of their health care needs and the less than optimal health outcomes they often report (Kirschner et al. 2009; Gulley, Rasch, and Chan 2011a; Iezzoni 2011). Although use of

preventive care and other types of services by adults with disabilities have been studied in some depth (Iezzoni et al. 2001; Sommers 2006–2007; Henry et al. 2011; Iezzoni, Frakt, and Pizer 2011), their pattern of ED use has not received attention. In the general adult population, it is known that such factors as access to primary care, immediacy of medical needs, ability to pay for services, and type of insurance coverage influence whether individuals choose to use ED services (GAO 1993; Medicaid Access Study Group 1994; IOM 2007a; Pitts et al. 2008; Rust et al. 2008; Cheung, Wiler, and Ginde 2011). As many of these issues also present challenges for adults with disabilities, it is likely that these factors do influence their use of ED services. However, there is little current evidence to suggest the net direction of these effects.

It could be hypothesized that ED use might be elevated among adults with disabilities as they share commonalities with heavy users of the ED. Like heavy ED users, adults with disabilities have complex health profiles (Coughlin, Long, and Kendall 2002). They are frequent users of ambulatory and hospital care (Coughlin, Long, and Kendall 2002; Long, Coughlin, and Kendall 2002) and they are known to have difficulty accessing primary and preventive care (Iezzoni et al. 2002; Long, Coughlin, and Kendall 2002). They have more chronic and acute health conditions than their peers without reported limitations, and they accumulate these conditions more quickly (Gulley, Rasch, and Chan 2011b; Rasch et al. 2008). In general, adults with disabilities have poorer health and mental health status than their peers (Steinmetz May 2006). Thus, more vigilance may be required to maintain optimal health in this group because they have a "thinner margin of health" (Dejong et al. 2002). However, the extent to which access to medical care affects use of ED services by adults with disabilities has not been reported, nor has their overall ED use been described. These are critically important considerations for determining how to optimize health care service delivery for this population.

Accordingly, the purpose of this study was to examine the relationship between ED use and access to medical care and prescription medications among two nationally representative groups of working age Americans with

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self-reported limitations in comparison to a reference group of adults without limitations. We chose to focus our examination of ED use on working age adults. Although a greater proportion of retirement-age adults have disabilities, a greater overall number of working age adults have disabilities because the working age population is so large (Dejong et al. 2002). Although considerable research has been directed toward the health and long-term care needs of older Americans, far less emphasis has been placed on these issues among working age adults with disabilities, many of whom are uninsured. We present a profile of three groups of working age adults with and without self-reported limitations by level of ED use to begin to elucidate the range of factors driving use of ED services.

METHODS

Data Source

Data from the Household Component (HC) of the Medical Expenditure Panel Survey as well as the medical conditions and medical events files were pooled from 2006 to 2008 to create a multiyear annual file (Agency for Healthcare Research and Quality [AHRQ] 2007). The MEPS uses an overlapping panel design whereby data are collected longitudinally through five rounds of household interviews over a 2-year period. However, an annualized file can be created that includes all respondents in both panels for a particular calendar year. We pooled annualized files for 3 years to improve the precision of our estimates. The MEPS uses a multistage probability sampling design representative of community-dwelling civilians in the United States. We restricted our analysis to working age adults (18–64 years of age) yielding a final analytic sample size of 53,586 individuals representing roughly 185 million adults in the United States. The NIH Office of Human Subjects Research determined that federal regulations for the protection of human subjects do not apply to this work as these data are de-identified and in the public domain. Survey design and methods for the MEPS have been well documented.

Analytic Groups

In the most recent release of data from the American Community Survey (2010), which replaced the long form of the census, 10 percent (roughly 19 million) of working age adults in the United States were identified with a disability as measured by self-reported limitations in hearing, vision, cognition, walking,

self-care, or independent living such as going to a doctor or shopping (U.S. Census Bureau 2012). Other national estimates are much higher due to issues around the conceptualization and measurement of disability (Altman 2009). Contemporary models of disability depict it as the outcome of the interaction between individual capabilities and environmental demands (Verbrugge and Jette 1994; Brandt and Pope 1997; WHO 2001; IOM 2007b). Disability occurs along a continuum of human functioning, although it is often described as a dichotomy. It is a complex, multidimensional, and dynamic concept reflecting a heterogeneous population. However, methods of measuring disability have not advanced to the same degree as its conceptualization. Therefore, disability is often characterized by measures that focus on self-reported limitations in basic activities such as walking, bending, reaching, or carrying, and more complex activities such as self-care, working, shopping, or managing money. As such, the population generally identified with a disability from national surveys is the proportion of individuals who report difficulty performing routine activities because of limited capabilities, environmental barriers, or both.

To remain consistent with how disability is measured in the MEPS, we categorized three mutually exclusive groups of adults based on self-reported limitations: (1) those without self-reported limitations; (2) those reporting limitations that did not affect activities of daily living (ADLs) or instrumental activities of daily living (IADLs); and (3) those receiving help or supervision with ADLs or IADLs. Adults reporting the need for help or supervision with ADLs such as dressing or bathing, or IADLs such as meal preparation or taking medications were classified in Group 3 (adults with ADL/IADL limitations). Adults who did not report ADL/IADL limitations but reported any other type of limitation such as those affecting motor and sensory functioning, cognition, work, housework or school, socialization, or use of assistive devices were classified in Group 2 (adults with non-ADL/IADL limitations). Those without self-reported limitations were classified in Group 1. Allowing for more than one disability group better accounts for the heterogeneity of medical needs in this population. In previous work, we found that this grouping method coincides with progressively elevated needs for health care services where adults without limitations have the lowest service use and adults with ADL/IADL limitations have the highest service use (Gulley, Rasch, and Chan 2011b).

Measures

Self-reported health conditions (including physical conditions, injuries, and mental or emotional health conditions) were enumerated at the beginning of

each round of MEPS data collection and converted to ICD-9-CM codes. We identified chronic health conditions by applying a well-validated list of chronic medical conditions (Hwang et al. 2001) to MEPS International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) codes. The list includes self-reported medical or mental health conditions expected to last at least 12 months and result in the need for ongoing intervention and/or some type of limitation. Reported conditions that were not on this list were counted as non-chronic conditions.

Access to care was assessed by responses to questions about whether needed medical care was obtained or whether receipt of this care was delayed. Similar questions were asked about prescription medications. Separate indicators were created for access to medical care and access to prescription medications such that an affirmative response to either question about delay or nonreceipt of care indicated poor access.

Control variables included age (continuous variable), gender, race-ethnicity (non-Hispanic White, non-Hispanic Black, Hispanic, and other), education (no high school or GED degree versus high school, GED, or higher degree), poverty status (family income as a percentage of the national poverty threshold), and insurance status (summary indicator for persons in the calendar year). Health and mental health status were included for descriptive purposes. They reflect overall self-reported health and mental health status, rated as excellent, very good, good, fair, or poor compared to other people of the respondent's age.

We characterized heavy ED users to better understand their relationship with and potential overlap with the population of adults with disabilities. Heavy ED users were defined as those having four or more ED visits during the year (Hunt et al. 2006). Among heavy ED users, we examined use of other health care services to better characterize the service needs and health profiles of this group. Finally, we examined the health conditions that respondents indicated were associated with ED visits.

Statistical Analysis

We conducted a series of bivariate and multivariate analyses comparing the three analytic groups. For pairwise *t*-tests of significance, we controlled the false discovery rate (Benjamin and Hochberg 1995). Special modeling considerations were necessary for the analysis of ED visits due to their distribution in the population. ED visits represent event counts where the event is rare and there are an excess number of zero observations as the majority of adults do not have ED visits. The number of zero values in our data was higher than that

expected for a Poisson or negative binomial model. For these reasons, we applied zero inflated negative binomial (ZINB) regression models to examine ED visits (Afifi et al. 2007a). This is a two-part modeling approach where one part of the model uses logistic regression to yield the probability of excess zeroes (inflate) across parameters of the model. In the other part, negative binomial regression yields the predicted number of ED visits by group and access to care while controlling for covariates. We performed the Vuong test to verify the necessity of the zero inflation component of the model and the likelihood ratio test (alpha) to verify the need for the ZINB approach due to over-dispersion in the Poisson model (Afifi et al. 2007a). In the regression models, we controlled for age, gender, race-ethnicity, education, poverty status, insurance status, census region, and MSA status.

Medical Expenditure Panel Survey person-level sample weights that adjusted for differential selection probability were used to produce population estimates. Variance estimation was performed through Taylor linearization. Estimates were based on a minimum of 30 responses per analytic cell and relative standard errors less than 30 percent (Hendershot, Larson, and Lakin 2003).

RESULTS

Working Age Adults with Disabilities

In total, 17 percent of US working age adults reported some type of limitation. More specifically, 3.7 percent reported the need for help or supervision with ADLs/IADLs (Group 3) while another 13.2 percent reported non-ADL/IADL limitations (Group 2). These two groups were of similar age, although both were older than their counterparts without disabilities (Group 1). A greater proportion of adults with limitations were women, non-white, did not complete high school, were poor, and were in fair/poor health and mental health compared to adults without limitations.

As shown in Table 1, there is a complex relationship between disability status, number of chronic and non-chronic conditions, access to care, insurance coverage, and ED use. Generally, more adults with disabilities reported delayed or nonreceipt of medical care and prescription medications compared to other working age adults. Among those with poor access to care, a greater percentage reported insurance gaps. This was true for all adults regardless of disability status. Adults with disabilities had more chronic and non-chronic conditions than their peers, particularly Group 3 (ADL/IADL limitations). This effect was more pronounced among those with poor access to care.

Table 1:   Sample and Population Distributions, Health, Insurance Coverage, Access to Care, and Service Utilization among All Working Aged Persons and on the Basis of Disability Status: Pooled Annual Estimates, MEPS 2006–2008

Measures	Total	Group 1: No Disability[a]	Group 2: Non-ADL/IADL Disability[b]	Group 3: ADL/IADL Disability[c]
Sample and population distributions				
Sample size	53,586	44,133	7,190	2,263
Weighted percent of all adults 18–64 (SE)	[100%]	83.2%	13.2%	3.7%
Weighted population size, millions	184.7	153.6	24.3	6.8
Mean age (SE)	41.3 (.12)	40.0 (.12)[b,c]	47.7 (.24)[a]	47.5 (.40)[a]
Percent female (SE)	50.8% (.24)	49.9% (.26)[b,c]	53.9% (.73)[a,c]	58.6% (1.48)[a,b]
Race/ethnicity, percent (SE)				
Non-Hispanic white	66.7% (.73)	65.9% (.76)[b]	71.6% (.92)[a,c]	66.5% (1.53)[b]
Non-Hispanic black	11.9% (.48)	11.4% (.47)[b,c]	13.3% (.67)[a,c]	17.4% (1.20)[a,b]
Non-Hispanic other or multiple race	6.9% (.33)	7.1% (.36)[b]	5.8% (.42)[a]	6.3% (.77)
Hispanic (any race)	14.5% (.56)	15.6% (.60)[b,c]	9.3% (.59)[a]	9.9% (.82)[a]
Percent less than high school education	13.4% (.31)	12.4% (.34)[b,c]	16.4% (.61)[a,c]	26.0% (1.26)[a,b]
In poverty (<125% FPL), percent (SE)	14.2% (.30)	11.9% (.30)[b,c]	23.1% (.70)[a,c]	35.0% (1.44)[a,b]
Health conditions and status				
Mean non-chronic conditions (SE)	1.9 (.02)	1.6 (.02)[b,c]	3.0 (.04)[a,c]	3.9 (.10)[a,b]
Mean chronic conditions (SE)	1.2 (.01)	0.9 (.01)[b,c]	2.7 (.04)[a,c]	3.8 (.10)[a,b]
Percent in fair to poor overall health (SE)	19.6% (.31)	12.1% (.25)[b,c]	51.5% (.93)[a,c]	75.2% (1.36)[a,b]
Percent in fair to poor mental health (SE)	12.0% (.24)	6.8% (.19)[b,c]	32.3% (.80)[a,c]	57.7% (1.47)[a,b]
Insurance coverage status				
Insured all year	70.4% (.42)	70.1% (.47)[c]	69.5% (.74)[c]	79.1% (1.10)[a,b]
Uninsured part year	12.1% (.21)	12.0% (.23)[c]	12.9% (.51)[c]	10.0% (.69)[a,b]
Uninsured all year	17.6% (.35)	17.9% (.39)[c]	17.6% (.64)[c]	11.0% (.84)[a,b]
Utilization of health services				
Percent with one or more ED visits	12.5% (.20)	10.1% (.20)[b,c]	21.4% (.58)[a,c]	35.1% (1.31)[a,b]

Table 1. *Continued*

Measures	Total	Group 1: No Disability[a]	Group 2: Non-ADL/IADL Disability[b]	Group 3: ADL/IADL Disability[c]
Percent hospitalized (SE)	6.6% (.13)	4.9% (.13)[b,c]	11.8% (.47)[a,c]	25.2% (1.19)[a,b]
Mean annual ambulatory visits to primary MDs (SE)	1.0 (.01)	0.8 (.01)[b,c]	1.8 (.05)[a,c]	2.6 (.11)[a,b]
Mean annual visits to specialty MDs (SE)	2.1 (.03)	1.6 (.03)[b,c]	4.2 (.13)[a,c]	7.1 (.31)[a,b]
Mean annual visits to non-MDs (SE)	2.2 (.06)	1.6 (.04)[b,c]	4.3 (.18)[a,c]	7.8 (.61)[a,b]
Mean prescription fills/refills (SE)	9.9 (.15)	6.5 (.11)[b,c]	22.5 (.50)[a,c]	42.2 (1.32)[a,b]
Access to care				
Medical care delayed or not received	6.3% (.18)	4.5% (.16)[b,c]	14.8% (.60)[a,c]	17.9% (1.00)[a,b]
Mean non-chronic conditions	3.0 (.06)	2.4 (.06)[b,c,1]	3.6 (.10)[a,c,2]	4.8 (.21)[a,b,3]
Mean chronic conditions	2.1 (.05)	1.3 (.05)[b,c,1]	3.0 (.09)[a,c,2]	4.3 (.22)[a,b,3]
Percent with any insurance gap	51.2% (1.25)	53.3% (1.66)[c,1]	50.8% (1.79)[c,2]	40.1% (3.23)[a,b,3]
Percent with one or more ED visits	24.0% (.99)	18.4% (1.14)[b,c,1]	27.7% (1.72)[a,c,2]	44.7% (3.33)[a,b,3]
Medical care received on time	93.7% (.18)	95.5% (.16)[b,c]	85.3% (.60)[a,c]	82.1% (1.00)[a,b]
Mean non-chronic conditions	1.8 (.02)	1.6 (.02)[b,c]	2.9 (.04)[a,c]	3.8 (.10)[a,b]
Mean chronic conditions	1.2 (.01)	0.9 (.01)[b,c]	2.6 (.04)[a,c]	3.7 (.10)[a,b]
Percent with any insurance gap	28.2% (.44)	28.8% (.48)[b,c]	26.9% (.72)[a,c]	16.8% (1.11)[a,b]
Percent with one or more ED visits	11.7% (.20)	9.7% (.19)[b,c]	20.3% (.62)[a,c]	33.0% (1.47)[a,b]
Prescription medications delayed/not received	4.3% (.14)	2.7% (.12)[b,c]	11.6% (.48)[a,c]	15.8% (.90)[a,b]
Mean non-chronic conditions	3.3 (.08)	2.6 (.08)[b,c,1]	3.7 (.11)[a,c,2]	5.0 (.23)[a,b,3]
Mean chronic conditions	2.8 (.07)	1.9 (.06)[b,c,1]	3.5 (.12)[a,c,2]	4.8 (.21)[a,b,3]

Table 1. *Continued*

Measures	Total	Group 1: No Disability[a]	Group 2: Non-ADL/IADL Disability[b]	Group 3: ADL/IADL Disability[c]
Percent with any insurance gap	45.7% (1.29)	45.6% (1.79)[c,1]	49.3% (2.25)[c,2]	36.6% (3.65)[a,b,3]
Percent with one or more ED visits	26.3% (1.17)	21.5% (1.65)[b,c,1]	27.0% (1.86)[a,c,2]	43.0% (3.45)[a,b,3]
Prescription medications received on time	95.7% (.14)	97.3% (.12)[b,c]	88.4% (.48)[a,c]	84.2% (.90)[a,b]
Mean non-chronic conditions	1.8 (.02)	1.6 (.02)[b,c]	3.0 (.04)[a,c]	3.8 (.10)[a,b]
Mean chronic conditions	1.2 (.01)	0.9 (.01)[b,c]	2.6 (.04)[a,c]	3.6 (.10)[a,b]
Percent with any insurance gap	28.9% (.43)	29.4% (.47)[c]	28.0% (.74)[c]	18.0% (1.13)[a,b]
Percent with one or more ED visits	11.9% (.20)	9.8% (.19)[b,c]	20.7% (.63)[a,c]	33.6% (1.41)[a,b]

Note. After controlling the false discovery rate, the given estimate differs significantly ($p < .05$) from the estimate for persons with: a, no disability; b, non-ADL/IADL disability; c, ADL/IADL disability; 1, no disability and who did not report the given access problem; 2, non-ADL/IADL disability and who did not report the given access problem; 3, ADL/IADL disability and who did not report the given access problem.
ADL, activities of daily living; ED, emergency department; FPL, federal poverty level; IADL, instrumental activities of daily living; MD, medical doctor.

Adults with disabilities also had the greatest ED use, which was most pronounced in the context of poor access to care. They also consumed other health care services at higher rates than their peers.

ED Use

A total of 13 percent of working age adults reported one or more ED visits in a year, amounting to roughly 32 million visits. Adults with disabilities accounted for 39.2 percent of total annual U.S. ED visits despite representing just 17 percent of the working age population. More specifically, 13.2 percent of total ED visits went to the 4 percent of U.S. adults in Group 3 (ADL/IADL limitations), whereas 25.9 percent of ED visits went to the 13 percent of adults in Group 2 (non-ADL/IADL limitations). As evident in Table 2, ED utilization level was associated with limitation status such that Group 3 (ADL/IADL limitations) visited the ED more often during the year than their peers. The majority of adults without ED visits during the year (85.5 percent) were those without self-reported limitations (Group 1). By contrast, the majority of adults

Table 2: Sample and Population Distributions, Health and Disability, Insurance Status, Access to Care, and Service Utilization on the Basis of Number of Annual ED Visits: Pooled Annual Estimates, MEPS 2006–2008

Measures	0 ED Visits[a]	1 ED Visit[b]	2–3 ED Visits[c]	4+ ED Visits[d]
Sample and population distributions				
Sample size	46,533	5,241	1,570	242
Weighted percent of all adults 18–65 (SE)	87.5% (.20)	9.5% (.17)	2.6% (.09)	0.4% (.04)
Weighted population size, millions	161.7	17.5	4.8	0.8
Mean age (SE)	41.4 (.12)[b]	40.5 (.2.5)[a]	41.1 (.45)	41.8 (1.09)
Percent female (SE)	49.9%(.26)[b,c,d]	55.2% (.85)[a,c,d]	59.9% (1.58)[a,b,d]	70.0% (3.64)[a,b,c]
Race/ethnicity, percent (SE)				
Non-Hispanic white	66.7% (.75)	66.7% (1.00)	65.0% (1.51)	68.9% (3.49)
Non-Hispanic black	11.3% (.47)[b,c,d]	15.7% (.77)[a]	17.5% (1.16)[a]	19.2% (3.00)[a]
Non-Hispanic other or multiple race	7.2% (.35)[b,c]	4.9% (.45)[a]	4.4% (.62)[a]	–
Hispanic (any race)	14.8% (.58)[b,d]	12.7% (.66)[a,d]	13.0% (1.01)[d]	7.3% (1.53)[a,b,c]
Percent less than high school education	13.0% (.33)[b,c]	15.2% (.61)[a,c]	20.6% (1.20)[a,b]	18.8% (2.74)
In poverty (<125% FPL), percent (SE)	12.9% (.29)[b,c,d]	21.5% (.70)[a,c,d]	29.6% (1.44)[a,b,d]	41.1% (3.90)[a,b,c]
Disability status				
Percent no limitations (SE)	85.5% (.31)[b,c,d]	71.9% (.81)[a,c,d]	54.9% (1.59)[a,b,d]	34.6% (3.86)[a,b,c]
Mean non-chronic conditions (SE)	1.5 (.02)[b,c,d,2,3]	2.6 (.04)[a,c,d,2,3]	3.3 (.08)[a,b,d,2,3]	4.2 (.31)[a,b,c,3]
Mean chronic conditions (SE)	0.9 (.01)[b,c,d,2,3]	1.2 (.03)[a,c,d,2,3]	1.5 (.07)[a,b,2,3]	1.8 (.25)[a,b,2,3]
Percent non-ADL/IADL limitations (SE)	11.8% (.27)[b,c,d]	20.1% (.74)[a,c,d]	28.5% (1.45)[a,b,d]	42.0% (3.98)[a,b,c]
Mean non-chronic conditions (SE)	2.8 (.04)[b,c,d,1,3]	3.8 (.09)[a,c,d,1,3]	4.3 (.15)[a,b,1,3]	4.9 (.41)[a,b,3]
Mean chronic conditions (SE)	2.5 (.04)[b,c,d,1,3]	3.0 (.09)[a,d,1,3]	3.2 (.15)[a,d,1,3]	4.4 (.44)[a,b,c,1,3]
Percent ADL/IADL limitations (SE)	2.7% (.11)[b,c,d]	8.0% (.43)[a,c,d]	16.6% (1.14)[a,b,d]	23.3% (3.13)[a,b,c]
Mean non-chronic conditions (SE)	3.3 (.10)[b,c,d,1,2]	4.7 (.22)[a,c,d,1,2]	5.3 (.22)[a,b,d,1,2]	7.0 (.71)[a,b,c,1,2]
Mean chronic conditions (SE)	3.4 (.10)[b,c,d,1,2]	4.0 (.17)[a,c,d,1,2]	5.0 (.27)[a,b,1,2]	5.9 (.48)[a,b,1,2]
Health status				
Percent in fair to poor overall health (SE)	16.8% (.29)[b,c,d]	33.7% (.87)[a,c,d]	52.1% (1.61)[a,b,d]	77.9% (3.69)[a,b,c]

Table 2.   *Continued*

| Measures	0 ED Visits[a]	1 ED Visit[b]	2–3 ED Visits[c]	4+ ED Visits[d]
Percent in fair to poor mental health (SE)	10.5% (.23)[b,c,d]	19.5% (.74)[a,c,d]	30.3% (1.50)[a,b,d]	49.1% (4.15)[a,b,c]
Insurance coverage status				
Percent insured all year (SE)	70.8% (.45)[b,c,d]	67.8% (.83)[a]	65.7% (1.50)[a]	59.3% (3.99)[a]
Percent uninsured part year (SE)	11.5% (.21)[b,c,d]	15.9% (.68)[a]	17.1% (1.13)[a]	21.5% (3.47)[a]
Percent uninsured all year (SE)	17.7% (.37)	16.3% (.67)	17.2% (1.27)	19.2% (2.82)
Access to care				
Percent medical care delayed/not received (SE)	5.5% (.18)[b,c,d]	10.3% (.55)[a,c,d]	16.7% (1.24)[a,b,d]	25.0% (3.34)[a,b,c]
Percent prescription meds: delayed/not received (SE)	3.7% (.13)[b,c,d]	7.4% (.48)[a,c,d]	13.8% (1.13)[a,b]	20.9% (3.13)[a,b]
Utilization of other health services				
Mean annual ambulatory visits to primary MDs (SE)	0.9 (.01)[b,c,d]	1.5 (.04)[a,c,d]	2.0 (.09)[a,b,d]	3.1 (.34)[a,b,c]
Mean annual visits to specialty MDs (SE)	1.8 (.03)[b,c,d]	3.4 (.12)[a,c,d]	5.0 (.26)[a,b,d]	8.1 (1.23)[a,b,c]
Mean annual visits to non-MDs (SE)	2.0 (.05)[b,c,d]	3.5 (.20)[a,c,d]	4.9 (.42)[a,b]	5.9 (1.14)[a,b]
Mean prescription fills/refills (SE)	8.8 (.14)[b,c,d]	15.6 (.39)[a,c,d]	23.1 (.97)[a,b,d]	38.9 (3.17)[a,b,c]
Percent hospitalized (SE)	3.7% (.11)[b,c,d]	22.6% (.73)[a,c,d]	37.4% (1.41)[a,b]	44.7% (3.83)[a,b]

Note. After controlling the false discovery rate, the given estimate differs significantly ($p < .05$) from the estimate for persons with: a, zero ED visits; b, one ED visit; c, two to three ED visits; d, four ED visits; 1, the same level of ED use and no limitations; 2, the same level of ED use and non-ADL/IADL limitations; 3, the same level of ED use and ADL/IADL limitations.
ADL, activities of daily living; AMB, ambulatory; FPL, federal poverty level; IADL, instrumental activities of daily living; MD, medical doctor.

(65.4 percent) with four or more ED visits during the year were those with self-reported limitations. It is noteworthy that despite their small numbers in the general population, individuals in Group 3 (ADL/IADL limitations) represented almost one quarter (23.3 percent) of heavy (four or more annual visits) ED users. Similarly, as the level of ED utilization increased, so did the number of chronic and non-chronic conditions as well as the percentage of adults with fair to poor health and mental health status.

Conditions Associated with ED Visits

By far, the largest single reason for ED visits was injury (including poisoning, ICD9 800–999), representing 28.4 percent of all ED visits. This was true for adults with and without limitations. However, adults without limitations (Group 1) had significantly higher visits associated with injury (31.5 percent) than did Group 2 (24.6 percent) or Group 3 (21.7 percent). The next largest category of conditions associated with ED visits included "symptoms, signs, and ill-defined conditions" (ICD9 780–799) representing 10.5 percent of all visits. More ED visits were attributable to this category for the two groups with disabilities (12.3 percent and 12.1 percent, respectively) compared to those without reported limitations (9.4 percent). Adults without limitations reported the most normal pregnancy-related (ICD9 V22) ED visits (3.7 percent), whereas less than 1.7 percent of adults with limitations reported visits for this reason. Figure 1 depicts the relative distribution of visits across groups associated with the remaining conditions that accounted for the majority of ED visits. It is clear that the ED is a source of care for a wide variety of chronic and non-chronic conditions. For nearly all condition categories, adults with disabilities accounted for greater percentages of ED visits compared to their peers without disabilities. For adults with limitations, the frequency of visits associated with back/neck conditions, hypertension, mental disorders, heart conditions, and pneumonia/bronchitis was particularly high. In Group 3 (ADL/IADL limitations), roughly one-third (37.5 percent) of ED visits were associated with chronic conditions (37.5 percent). In Group 2 (non-ADL/IADL limitations), a similarly high amount of ED visits (31.5 percent) was associated with chronic conditions, whereas for Group 1 (no limitations), this figure was significantly lower (17.4 percent). Finally, there were more ambulatory care sensitive conditions (i.e., conditions associated with hospital stays that could potentially be avoided through good ambulatory care) associated with ED visits in Group 3 (21.6 percent) and Group 2 (17.9 percent) compared to Group 1 (12.8 percent).

Figure 1:   Relative Distribution of Conditions across Analytic Groups Associated with the Majority of Emergency Department Visits: Pooled Annual Estimates MEPS 2006–2008
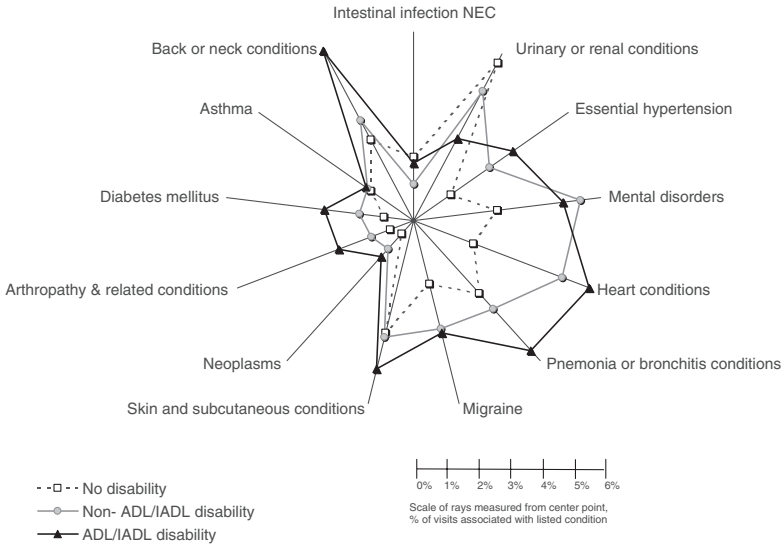
Note. When describing the percentage of ED visits across groups associated with particular conditions, counts may exceed 100 percent as individuals could report more than one condition associated with an ED visit. "Injuries," "symptoms, signs, and ill-defined conditions," and "pregnancy" were reported in "Results" and not included in graph to improve legibility.

Access to Medical Care and Prescription Medications

Emergency department use was positively associated with poor access to care (Table 2). For instance, only 5.5 percent of adults with no ED visits reported delay or nonreceipt of medical care, while 25.0 percent of adults with four or more ED visits reported access problems. Of working age adults, those reporting limitations had the most difficulty accessing needed medical care and medications. Poor access to medical care was only reported by 4.5 percent of adults without limitations (Group 1) in contrast to Group 2 (non-ADL/IADL limitations) where 14.8 percent reported poor access and Group 3 (ADL/IADL limitations) where access problems were more prevalent still at 17.9 percent. Similarly, poor access to prescription medications was low among adults without limitations (2.7 percent) compared to adults in Group 2 (11.6 percent) or Group 3 (15.8 percent).

Profile of Heavy ED Users Compared to Adults with Disabilities

Heavy ED users accounted for 13.0 percent of annual ED visits among working age adults, whereas those with three or more visits accounted for nearly a quarter (22.5 percent) of all ED visits. The frequency of ED visits was associated with the use of other health care services suggesting that the health care needs of adults visiting the ED are multifaceted (see Table 2). Heavy ED users had a much greater likelihood of hospitalization during the year than those who attended the ED less often. With this in mind, it is especially compelling that 40.7 percent of heavy ED users were uninsured all or part of the year. It is noteworthy that the profile of heavy ED users mirrors that of adults with disabilities. In fact, this is because adults with disabilities comprise 65.4 percent of heavy ED users. On average, adults with self-reported limitations had more chronic and non-chronic conditions than their peers and they used other health care services more frequently, including primary MD visits, specialist visits, non-MD visits, as well as prescription refills (Table 1). Only 4.9 percent of Group 1 (no limitations) were hospitalized compared to 11.8 percent of Group 2 (non-ADL/IADL limitations) and 25.2 percent of Group 3 (ADL/IADL limitations).

Multivariate Modeling

Results of the ZINB models for access to medical care (left panel) and access to prescription medications (right panel) are shown in Table 3. Examination of the negative binomial portion of the model for access to medical care indicates that the rate of ED visits was significantly higher for adults with limitations, those with poor access to medical care, and those with more chronic and non-chronic conditions after controlling for other factors in the model. In addition, non-Hispanic black adults, those with lower incomes, less than a high school education, and/or insurance gaps during the year also had significantly higher estimated ED visit rates. Examination of the "inflate" portion of the model indicates that individuals with more chronic and non-chronic conditions and non-Hispanic black adults had a significantly lower likelihood of having no ED visits. In other words, they were more likely to have an ED visit. These same findings hold for the model of access to prescription medications. The adjusted mean number of predicted ED visits is shown in Figure 2, indicating that more ED visits were associated with poor access to medical care, the presence of self-reported limitations (particularly ADL/IADL limitations),

Table 3: Zero Inflated Negative Binomial Models of Emergency Department Visits on the Basis of Access to Medical Care, Access to Prescription Medications, Health Conditions, Disability Status, and Covariates: Pooled Annual Estimates, MEPS 2006–2008

| | Access to Medical Care | | | | Access to Prescription Medications | | | |
| | Count Equation (Negative Binomial) | | Inflate Equation (Logit) | | Count Equation (Negative Binomial) | | Inflate Equation (Logit) | |
	Coefficient (SE)	Incidence Rate Ratio [95% CI]	Coefficient (SE)	Odds Ratio [95% CI]	Coefficient (SE)	Incidence Rate Ratio [95% CI]	Coefficient (SE)	Odds Ratio [95% CI]
Sociodemographics								
Age (years)	−.019 (.001)***	0.98 [0.98 : 0.98]	.000 (.008)	1.00 [0.98 : 1.02]	−.020 (.002)***	0.98 [0.98 : 0.98]	.002 (.008)	1.00 [0.99 : 1.02]
Is female	−.075 (.037)*	0.93 [0.86 : 0.99]	.335 (.180)	1.40 [0.98 : 1.99]	−.076 (.037)*	0.92 [0.86 : 0.99]	.349 (.180)	1.42 [1.00 : 2.02]
Race/ethnicity								
Not Hispanic, white (base case)	0	1	0	1	0	1	0	1
Not Hispanic, black	.387 (.046)***	1.47 [1.34 : 1.61]	−.846 (.199)***	0.43 [0.29 : 0.63]	.385 (.047)***	1.47 [1.34 : 1.61]	−.862 (.199)***	0.42 [0.29 : 0.62]
Not Hispanic, other/multiple race	−.145 (.082)	.87 [0.74 : 1.02]	.083 (.490)	1.09 [0.41 : 2.85]	−.147 (.083)	.86 [0.73 : 1.01]	.066 (.493)	1.07 [0.41 : 2.81]
Hispanic of any race	.093 (.054)	1.10 [0.99 : 1.22]	−.048 (.277)	0.95 [0.55 : 1.64]	.093 (.055)	1.10 [0.99 : 1.22]	−.040 (.273)	0.96 [0.56 : 1.64]
Less than high school education	.134 (.045)**	1.14 [1.05 : 1.25]	.145 (.225)	1.16 [0.74 : 1.80]	.135 (.046)**	1.14 [1.05 : 1.25]	.136 (.225)	1.15 [0.74 : 1.78]
Poverty status								
Poor or near poor (<125% FPL)	.465 (.057)***	1.59 [1.42 : 1.78]	−.461 (.258)	0.63 [0.38 : 1.05]	.463 (.057)***	1.60 [1.42 : 1.78]	−.426 (.259)	0.65 [0.39 : 1.09]
Low income (125% to <200% FPL)	.331 (.062)***	1.39 [1.23 : 1.57]	−.150 (.300)	0.86 [0.48 : 1.55]	.331 (.062)***	1.40 [1.23 : 1.57]	−.147 (.300)	0.86 [0.48 : 1.56]

Table 3. *Continued*

| | Access to Medical Care | | | | Access to Prescription Medications | | | |
| | Count Equation (Negative Binomial) | | Inflate Equation (Logit) | | Count Equation (Negative Binomial) | | Inflate Equation (Logit) | |
	Coefficient (SE)	Incidence Rate Ratio [95% CI]	Coefficient (SE)	Odds Ratio [95% CI]	Coefficient (SE)	Incidence Rate Ratio [95% CI]	Coefficient (SE)	Odds Ratio [95% CI]
Middle income (200% to <400% FPL)	.093 (.052)	1.09 [0.99 : 1.22]	−.053 (.230)	0.95 [0.60 : 1.49]	.091 (.052)	1.09 [0.98 : 1.21]	−.053 (.228)	0.95 [0.61 : 1.48]
High income (≥400% FPL, base case)	0	1	0	1	0	1	0	1
Lives in non-MSA area	.059 (.054)	1.06 [0.95 : 1.18]	−.404 (.225)	0.67 [0.43 : 1.04]	.058 (.054)	1.06 [0.95 : 1.18]	−.402 (.226)	0.67 [0.43 : 1.04]
Census region								
Northeast (base case)	0	1	0	1	0	1	0	1
Midwest	−.041 (.068)	0.96 [0.84 : 1.10]	.157 (.303)	1.17 [0.64 : 2.12]	−.043 (.067)	0.96 [0.84 : 1.10]	.152 (.300)	1.16 [0.65 : 2.10]
South	−.089 (.063)	0.91 [0.81 : 1.04]	.525 (.295)	1.69 [0.95 : 3.01]	−.093 (.063)	0.91 [0.81 : 1.03]	.522 (.293)	1.68 [0.95 : 3.00]
West	−.209 (.066)**	0.81 [0.71 : 0.92]	.748 (.300)*	2.11 [1.17 : 3.80]	−.209 (.066)**	0.81 [0.71 : 0.92]	.787 (.299)**	2.2 [1.22 : 3.95]
Health conditions and disability								
Number of non-chronic health conditions	.175 (.012)***	1.19 [1.16 : 1.22]	−3.401 (.408)***	0.03 [0.01 : 0.07]	.177 (.012)***	1.19 [1.17 : 1.22]	−3.414 (.397)***	0.03 [0.02 : 0.07]
Number of chronic health conditions	.071 (.010)***	1.07 [1.05 : 1.10]	−1.536 (.448)**	0.22 [0.09 : 0.52]	.070 (.010)***	1.07 [1.05 : 1.09]	−1.53 (.433)***	0.22 [0.09 : 0.51]
Disability status								
No limitations (base case)	0	1	0	1	0	1	0	1

Table 3.   Continued

| | Access to Medical Care | | | | Access to Prescription Medications | | | |
| | Count Equation (Negative Binomial) | | Inflate Equation (Logit) | | Count Equation (Negative Binomial) | | Inflate Equation (Logit) | |
	Coefficient (SE)	Incidence Rate Ratio [95% CI]	Coefficient (SE)	Odds Ratio [95% CI]	Coefficient (SE)	Incidence Rate Ratio [95% CI]	Coefficient (SE)	Odds Ratio [95% CI]
Non-ADL/IADL limitations	.341 (.052)***	1.41 [1.27 : 1.56]	−.466 (.452)	0.63 [0.26 : 1.53]	.344 (.051)***	1.41 [1.28 : 1.56]	−.500 (.457)	0.61 [0.25 : 1.49]
ADL/IADL limitations	.608 (.064)***	1.84 [1.62 : 2.08]	−.606 (.990)	0.55 [0.08 : 3.82]	.610 (.064)***	1.84 [1.62 : 2.09]	−.656 (.971)	0.52 [0.08 : 3.50]
Insurance and access to care								
Insurance coverage status								
Insured all year	0	1	0	1	0	1	0	1
Uninsured part year	.338 (.056)***	1.40 [1.25 : 1.57]	.117 (.249)	1.12 [0.69 : 1.84]	.340 (.055)***	1.41 [1.26 : 1.57]	.149 (.249)	1.16 [0.71 : 1.89]
Uninsured all year	.250 (.052)***	1.29 [1.16 : 1.42]	.124 (.226)	1.13 [0.73 : 1.77]	.260 (.051)***	1.30 [1.17 : 1.43]	.120 (.226)	1.13 [0.72 : 1.76]
Medical care delayed/not received	.191 (.056)***	1.21 [1.09 : 1.35]	−.127 (.446)	0.88 [0.37 : 2.12]	n/a	n/a	n/a	n/a
Prescription medications delayed/not received	n/a	n/a	n/a	n/a	.214 (.065)***	1.24 [1.09 : 1.41]	−.042 (.553)	0.96 [0.32 : 2.84]
Constant	−1.60 (.108)		2.845 (.544)		−1.59 (.107)		2.788 (.537)	

*p < .05; **p < .01; ***p < .001.
ADL, activities of daily living; FPL, federal poverty level; IADL, instrumental activities of daily living; MSA, metropolitan statistical area.

Figure 2:   Covariate Adjusted, Weighted Mean Predicted ED Visits among Working Age Adults by Access to Medical Care, Disability Status, and Number of Chronic Conditions: Pooled Annual Estimates MEPS 2006–2008
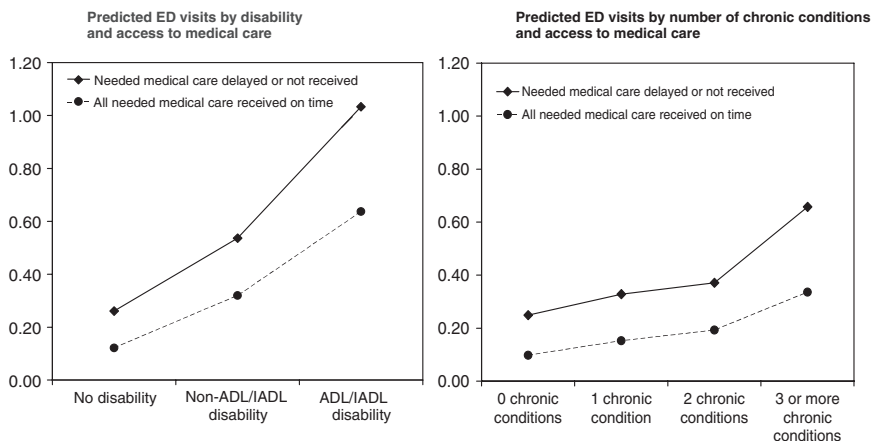
Note. Estimates are based upon a zero inflated negative binomial model of ED visits. In addition to number of chronic conditions and disability status, the model includes controls for sociodemographics, number of non-chronic health conditions, and insurance coverage status. For all three disability statuses and all four chronic condition levels, all differences between ED visits on the basis of access to medical care were significant at the $p < .05$ level. ADL, activities of daily living; IADL, instrumental activities of daily living.

and a greater number of chronic conditions. Similar results were obtained from the access to prescription medication model (available upon request).

LIMITATIONS

Our study has a few important limitations. Household surveys, such as the MEPS, are known to underestimate ED visits when compared to more direct data sources. Although the ED visit estimates reported in this study are likely to underrepresent the true magnitude of emergency encounters attributed to our analytic groups, the relative differences between groups are of primary interest. A study comparing MEPS household report of ED visits with actual service use did not detect differential bias, supporting the validity of relative group comparisons (Zuvekas and Olin 2009). Next, respondents may not recall all of their medical conditions, may not report conditions with specificity, may not be aware of the presence of a condition, and may not

report stigmatized conditions (Cox and Iachan 1987). Generally, these response errors result in underreporting of conditions compared to provider reports (Cox and Iachan 1987). As our data source was essentially cross-sectional in nature, we do not claim to make causal attributions on the basis of our analyses. It is important to note that health conditions do not equate with disability. Health conditions represent only one component of the multidimensional, dynamic, and interactive process that characterizes disability (Verbrugge and Jette 1994; Brandt and Pope 1997; WHO 2001; IOM 2007b). Data limitations prevent our analytic models from fully capturing this complexity. Finally, we recognize that primary care visits may actually drive ED visits, particularly in systems where there is not a mechanism to perform urgent tests. The ED may also be part of the pathway toward receipt of hospital care. Due to data limitations, we could not address these issues analytically, but we do acknowledge the intricacy of the issues potentially driving ED use.

DISCUSSION

We found that three key factors matter in relation to ED use among adults with disabilities: access to care and prescription medications, the complexity of individuals' health profiles, and disability status itself. Over 15 percent of adults with disabilities and 25 percent of high-end ED users, had difficulty obtaining needed medical care and/or prescription medications, and, controlling for covariates, poor access in these areas was significantly related to greater ED use. Health profiles of adults with disabilities are complicated and the conditions prompting an ED visit were wide ranging. For nearly all condition categories, adults with disabilities accounted for greater percentages of ED visits when compared to their peers without disabilities.

Modeling results indicated that disability status was strongly and independently related to ED visit rates. ED visit rates were 1.8 times higher for adults with ADL/IADL limitations and 1.4 times higher for adults with other limitations than their working age peers without limitations after controlling for other relevant factors. Although the MEPS did not permit more in-depth examination of the situational needs associated with disability that may have precipitated ED use, potential explanations are both practical and medical in nature. From a practical viewpoint, the availability of accessible facilities and medical equipment, the immediacy and sophistication of diagnostic tests, the hours of operation, and the availability of on-site personal assistance and

transportation may be particularly salient reasons for adults with disabilities to preferentially select ED services. From a medical viewpoint, the "thinner margin of health" among adults with disabilities may trigger heightened vigilance about emerging health issues. While a shoulder or hand injury may not require immediate attention for someone who is ambulatory, a wheelchair user with the same injury could be functionally devastated, requiring the need for home health care if not addressed immediately. For adults with disabilities living alone, the need may be all the more urgent. Similar scenarios can be envisioned for individuals with most types of cognitive, sensory, emotional, or mobility-related functional profiles. The nature of these functional profiles may drive immediacy of medical needs in unique and unexpected ways. With a particular emphasis on people with disabilities, we distill three key recommendations for policy makers and providers concerned with the use of the ED in the United States.

Start Upstream

Given the volume of conditions and the thinner margin of health among people with disabilities, the ED will always play an important role in their care. However, many of the ED visits made by people with disabilities are for conditions that, better managed, might not rise to the level of crisis care with such frequency. Results from a randomized controlled trial of older adults with chronic conditions support this assertion (Coleman et al. 2001). In addition, some conditions associated with ED visits might be preventable. Either way, prevention matters for people with disabilities. If designed with the functional limitations and service needs of people with disabilities in mind, early detection (Crane et al. 2010); community-based nutrition, exercise, and wellness programs (Pang et al. 2005); peer support; and chronic disease management programs (Afifi et al. 2007b; Dall et al. 2011) might each play a role in reducing ED visits.

Build a Medical Neighborhood That Includes the ED

As can be seen in our findings, providing optimal care to people with disabilities and chronic conditions in the community may be a complicated proposition. Consequently, their needs warrant special attention in the design of medical neighborhoods where patients, primary care physicians, specialists, other health care providers, and the ED all play an important role (Bodenheimer 2008; Fisher 2008). Given the volume of ED use by people with disabili-

ties, it is apparent that the ED may offer unique attributes that work and its advantages need to be further explored. To offer comprehensive care to people with disabilities, intensive primary care programs, such as the Commonwealth Care Alliance in Massachusetts, the Program of All-Inclusive Care for the Elderly, and disability care coordination organizations, such as Axis Healthcare in Minnesota, have sought to provide and/or coordinate a range of health and related services in the community (Master 1998; Coleman 2000; Palsbo and Ho 2007). Programs like these rely upon a mix of different methods such as case management, home medical visits, integration of psychosocial care, medication management, and 24/7 access to medical assistance. Even incremental adoption of these methods might curb ED use for some people with disabilities (Diedhiou et al. 2010).

Work Downstream

Emergency departments themselves have a role to play in preventing future ED visits. A steady two-way flow of detailed medical information is needed between the ED and other health care providers as EDs need access to recent medical records as much as primary care providers need access to information on recent ED visits. The importance of integration between the ED and other providers, the information technology that could be used to provide it, and the kinds of medical errors and other poor outcomes that result in its absence are already well documented (Bodenheimer 2008; Fisher 2008). However, these issues take on a special relevance for people with disabilities because they may have functional limitations that interfere with medical self-advocacy, because they have multiple health conditions that may involve care from many different providers and because they experience greater levels of poverty.

Conclusion

Although adults with disabilities represent 17 percent of the working age adult population, they accounted for almost 40 percent of annual ED visits. ED use was associated with poor access to care which was much more prevalent among adults with disabilities. The profile of heavy ED users mirrors that of adults with disabilities because the latter comprise 65 percent of heavy ED users. The health care needs of many adults with disabilities are complicated. More adults with disabilities were hospitalized during the year compared to their peers without disabilities and they had more ambulatory care sensitive

conditions associated with ED visits. For nearly all condition categories, adults with disabilities accounted for greater percentages of ED visits compared to their peers without disabilities. These results indicate that three key factors matter in relation to ED use among adults with disabilities: access to care, the complexity of health profiles, and disability status itself. Our findings support the call for reform of the U.S. health care system to better address the long-term service needs of all citizens, including those with disabilities, in a more effective and equitable way.

Acknowledgments

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Supporting Information

Additional supporting information may be found in the online version of this article:

Appendix SA1: Author Matrix.